FILE COPY FOREST INSECT LABORATORY, STANFORD UNIVERSITY CALIFORNIA

~~330.E~~ 642.

UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY

FOREST INSECT INVESTIGATIONS

REPORT OF THE 1926 CONTROL WORK IN THE CRATER LAKE PARK, OREGON.

(Second Annual Report)

By

J. E. Patterson,
Assistant Entomologist.
U. S. Department of Agriculture.

J. E. Patterson

Stanford University, Calif.
January 24, 1927.

GOVERNMENT PRINTING OFFICE

REPORT OF THE 1926 CONTROL WORK
IN THE CRATER LAKE PARK, OREGON.

OUTLINE OF TOPICS

SUMMARY OF THE REPORT ..... Page 1

FOREWORD ..... " 3

CONTROL WORK AND COST ..... " 3
- Preliminary Work ..... " 3
- Narrative of the Operations ..... " 3
- Location of the Control Work ..... " 5
- Number of Trees Treated ..... " 5
- Control Methods Used ..... " 5
- Cost of the Work ..... " 6
- Segregation of Cost ..... " 7
- Analysis of Cost ..... " 7

RESULTS OF THE CONTROL WORK AND CHARACTERISTICS OF THE INFESTATION ..... " 8
- Results ..... " 8
- Estimated 1927 Infestation ..... " 9
- Analysis of the Infestation ..... " 10
- Source of Re-infestations ..... " 10

RECOMMENDATIONS FOR 1927 ..... " 11
- Yellow pine Areas ..... " 11
- Lodgepole pine Areas ..... " 11

MAP OF THE PROJECT ..... " 13

PHOTOGRAPHS ..... " 14
- Illustrating Method of Treating Yellow pine ..... " 14
- Illustrating First Stage of the Sun Curing Method ..... " 15
- Illustrating Second " " " " " " ..... " 16
- Illustrating Last " " " " " " ..... " 17
- A Beetle Killed or "Ghost Forest" of Lodgepole pine .... " 18

REPORT OF THE 1926 CONTROL WORK IN THE CRATER LAKE PARK, OREGON.

(Second Annual Report)

By
J. E. Patterson,
Assistant Entomologist,
U. S. Department of Agriculture.

SUMMARY OF THE REPORT.

In the report of last year's control work in the Crater Lake Park it was recommended that control operations be continued during the season of 1926. Because the National Park Service appropriated funds necessary to carry out these recommendations it was possible to continue the control work in 1926 on the areas which were made control units in 1925.

The control work of 1926 was conducted during two separate periods. The first period, from May 1st to June 25th, was spent in treating a yellow pine infestation at the South Entrance, and treating lodgepole pine trees infested with overwintered broods of the mountain pine beetle. The second period, from August 8th to October 1st, was devoted to control work against this same beetle on areas previously worked and also on new areas which had been infested during the season. The trees treated during the latter period contained broods which would overwinter in these trees and which constituted the 1927 infestation. The cost of the operations during the past season amounted to $3,883.52. The previous expenditures totaled $5,761.64, making a total of all expenditures on the project to date of $9,645.16. A total of 6,803 infested trees have been treated. Of this total 43 were yellow pine infested with the western pine beetle, Dendroctonus brevicomis. The other 6,760 trees were lodgepole pine infested with the mountain pine beetle, Dendroctonus monticolae.

Two different methods of treating the infested trees were employed. The yellow pine trees infested with broods of the western pine beetle were felled in the usual way, and after felling the infested bark was removed and burned in pits dug in the ground. By burning the bark in pits fire hazard to the surrounding forest was eliminated. The method used in treating the lodgepole pine trees, which were infested with broods of the mountain pine beetle, is an entirely different one and was first extensively practiced on this project in 1925. The method consists of falling the trees in such a way as to allow the direct sunlight to reach the tops and sides of

the logs. After thorough exposure for a few days these logs were turned half over to expose the under side. There are very definite advantages favoring this method as compared to the usual method of burning the logs

The result of the control work so far accomplished is an average reduction of 86% in the infestations on all of the lodgepole pine areas which were placed under control in 1925. The only lodgepole pine areas where the control work has not been successful are those areas where re-infestation has resulted by the invasion of beetles from outside them. One of these areas is located at the East Entrance where an adjoining National Forest infestation keeps contributing to a re-infestation of the Park control area. The others are located in the Munson Valley region and represent mostly stands which have not been previously infested. It was definitely established that the re-infestation of these latter areas did not occur or originate from beetles breeding on the areas themselves, but were caused by an invasion of beetles from the old infested areas northeast of Crater Lake. The fact was also established that these old-standing infestations northeast of the lake have now disappeared, due to the near extinction of the lodgepole forest. For this reason it is not probable that further re-infestations of the control areas from this source will occur. The control of the yellow pine infestation at the South Entrance has been entirely successful.

Because of the re-infestation of some of the lodgepole pine areas further control work is necessary in order to secure a sufficient reduction of the infestations in the region of the Park south of the lake to prevent further beetle depredations. Further control work is recommended on all of the lodgepole pine areas where re-infestation has appeared since the control work of 1926. As practically all of this re-infestation has occurred in the Munson Valley region any further control work should be centered on these areas. It is recommended that this work be done in 1927 in order to secure final control of these infested areas before the infestation now on them increases to greater proportions. The control work recommended for 1927 will cost from $2,500 to $3,000. This amount should be made available for expenditure not later than April 1st, 1927.

REPORT OF WORK AND RESULTS.

FOREWORD.

The following is a report of the 1926 barkbeetle control operations carried out in the Crater Lake National Park during the past season. This paper is the second report to be submitted on this project. The first paper, dealing with the origin of the project and the first control work (that accomplished in 1925), together with recommendations for subsequent control work, was submitted in January, 1926. Reference is occasionally made to this first report in the present paper.

The first part of this paper is a narrative of the season's operations and of the cost of the work accomplished, while the second part deals with the results so far obtained and contains a description of the beetle infestations in this park.

Following the control work of last year it was confidently expected that some re-infestation would appear in the treated areas, and the recommendations for the present year, submitted in the report of that work, provided for an attack upon this re-infestation. The current year's work was directed mainly toward eliminating this re-infestation. In addition to this control work in the lodgepole pine stands an infestation in the yellow pine area at the South Entrance was treated.

Following the last control work, which was completed in October, a survey of the treated areas was made to determine the results of the control work and to secure data upon which to base recommendations for activities during the coming (1927) season.

I - CONTROL WORK AND COST.

Beginning May 1st, a preliminary reconnaissance of the treated areas was made, and on May 5th the control crew was moved into the Park and established at the South Entrance. Tools and equipment, which had been stored at Government Camp for the winter, were sledded over the snow to the control camp. A Reo Speed Wagon and a Ford light truck were loaned by Colonel Thomson, Superintendent, and greatly facilitated moving the camps and transportation of the men and equipment.

Control Work.

Control work was immediately started in the yellow pine stand at the South Entrance, designated Area J. Work in this area was continued until May 15th, when the control of the yellow pine infestation was completed.

On May 17th, control work in the lodgepole pine areas was started. From this date to the 20th the new area H, at the Garden of the Gods, was treated.

On May 21st, camp was moved to Lost Creek and the lodgepole pine areas in the south-eastern portion of the Park were worked. Areas A, B, C, D, and E, were treated from this camp.

On June 10th, camp was moved to Munson Valley, and Areas F and I were treated. Control work in these last areas was completed on June 20th, when the equipment was checked in, the control crew dismissed, and the control work for the spring season ended.

During the period June 25th to August 15th (approximately) the mountain pine beetles in this park are emerging from parent brood trees and attacking new trees. During this period they cannot be successfully combatted by present known control methods and consequently no control work was carried on.

While control of the beetles is impractical during the flight period it is the time particularly opportune for a study of the seasonal habits of the beetles and new methods designed to prevent attack on lodgepole pine were tried out. These experiments were located at the East Entrance. They were conducted during the period June 26th, to August 6th. The results secured will be submitted in a separate report. The expenses incurred were met mainly by the Bureau of Entomology. However, the Park Service assisted by allotting funds for the salaries of two assistants.

On August 6th, control forces were again organized and control work for the fall period started on August 9th in Area F, Munson Valley, which had been considerably re-infested since the spring control work. Work in this area was prosecuted until August 23rd, when the area was finished and the control crew removed.

During the period August 24th to September 11th control work was temporarly suspended and the crew assigned to removing and disposing of the logs and debris resulting from the treatment of the infested trees along the roads and near campsites.

On September 15th, control work was again resumed, operations being carried out in Area J - west of Crater Peak. Work on this area was continued until October 1st when due to the exhaustion of funds allotted to control work in this park it was necessary to shut down the operations for the year.

During the period from October 2nd to 9th, a complete survey of the Park was made by the writer and two assistants. The purpose of this survey was to secure data on the effect of the control work accomplished in 1925 and 1926, and to locate all epidemic centers of infestation north of the lake and east of the Park which might re-infest the controlled areas.

Location of Control Work:

The location of the control work and the number of trees treated on each unit of the project during the season of 1926 are shown in the following table:

Spring period. (May 5 to June 20).

Trees species.	Insect.	Year.	Location.	Number of trees treated.
Yellow pine	D.brevicomis	J	South Entrance	43
Lodgepole pine	D.monticolae	A	East Entrance	388
" "	" "	B	Lost Creek	85
" "	" "	C	Sand Creek	2
" "	" "	D	Wheeler Creek	10
" "	" "	E	Kerr Notch	436
" "	" "	F	Munson Valley	394
" "	" "	G	Anna Spring	0
" "	" "	H	Garden of Gods	324
" "	" "	I	Crater Peak	74
Total number of trees treated				1,756
Total number yellow pine trees treated				43
Total number lodgepole pine trees treated				1,713

Fall period. (August 9 to October 1).

Lodgepole pine	D.monticolae	F	Munson Valley	292
" "	" "	I	Crater Peak	464
Total number of trees treated				756

Total number of trees treated during the season	2,512
Total number of lodgepole pine trees treated	2,469

The location of the above designated control areas and the control work are shown on the map, page 13 .

Control Methods Used:

The treatment of the yellow pine trees in Area J, South Entrance, which were infested with Dendroctonus brevicomis, consisted of falling the trees, removing the infested bark from the logs, and burning the bark in specially prepared pits. Burning the bark in pits prevented the spread of the control fires and the consequent scorching of adjacent reproduction and cover, besides insuring the complete destruction of the broods of the beetles.

An entirely different method termed the "solar heat" or "sun-curing method", developed during last year's operations, was practiced in the treatment of the lodgepole pine trees infested with Dendroctonus monticolae. This method, while not new to entomologists, has not, to

the knowledge of the writer, before been employed extensively on control projects. The technique is as follows: The infested trees are felled so that their trunks will extend in a north and south direction. Placing the logs in this position is necessary in order to expose the top and both sides to direct sunlight during the course of the day. After the logs have been felled it is necessary to remove the limbs along the infested length and cut off the uninfested tops in order to fully expose the logs. After the logs have been prepared in the above way they are left to the exposure of the sun's rays for from 2 to 4 days. They are then turned half over and the under side exposed. In the case of the larger trees (above 20 inches D.B.H.) it is sometimes necessary to turn the logs twice, with intervals of at least 2 days between turnings, in order to fully expose all the bark surface. A temperature of 110 degrees F. will kill the mountain pine beetle in any stage of its development. The temperatures attained in the cambium layer of logs treated in the above way on this project ranged from 110 to 120 degrees F. with a minimum exposure of 1 hour to direct sunlight during any part of the period from 10AM to 3PM. The method is equally as effective and practical as any other known method of treatment of lodgepole pine infested with this beetle. It has over the burning method the following advantages: There is no fire scorching of adjacent green trees and no unsightly, partially fire consumed, logs are left. It is not necessary to haul the logs to openings to burn them, or to prepare fire lines, or to exercise other precautions against fire escaping into the standing forest. It does not create conditions attractive to these beetles, while the attractive influence of fire scorched trees is very great. And finally the sun-curing method does not destroy certain natural insect enemies of the beetles, such as the predacious Clerids, and the Hymenopterous and Dipterous parasites. In the application of the sun-curing method it was found that the cost of treating trees was very nearly the same as the cost of the burning method. When it is necessary in the use of the burning method to haul the logs to openings or deck them for burning, and to take precautions against control fires escaping to the surrounding forest, the sun-curing method is much cheaper.

Cost of the Work:

The previous expenditures on this project up to May 1, 1926, amounted to $5,761.64. The total expenditures for the past season's work, (period May 1st to October 15th, 1926), totaled $3,883.52, making a total for all expenses incurred on the project to date of $9,645.16.

The distribution of the expenses during 1926, as apportioned by the Park Service, is as follows:

Spring and fall control work	$2,943.87
Experimental work	280.00
Cleanup work along roads and on campsites .	659.65
Total expended during the year	$3,883.52

Segregation of Cost:

Period of work and subdivision.	Item.	Total expended.	Percent of total.
Spring- Control work	Wages	$1,360.30	72.2%
	Provisions (mess)	405.22	21.4%
	Fuel (Gas & oil)	24.71	1.3%
	Equipment	15.45	.8%
	Transportation	80.16	4.3%
	Total	$1,883.84	100.0%
Summer- Experimental work.	Wages	$260.00	
Summer- Cleanup work.	Wages	$384.65	58.3%
	Provisions (mess)	120.20	18.2%
	Rents (team hire)	64.60	10.0%
	Team feed	40.00	6.1%
	Transportation	50.00	7.4%
	Total	$659.65	100.0%
Fall- Control work.	Wages	$690.70	65.1%
	Provisions (mess)	267.45	25.2%
	Transportation	100.04	9.5%
	Telegraph Service	1.84	.2%
	Total	$1,060.03	100.0%
Summary - Spring and fall control work.	Wages	$2,051.00	69.7%
	Provisions (mess)	670.67	22.8%
	Fuel (gas & oil)	24.71	.8%
	Equipment	15.45	.5%
	Transportation	180.20	6.2%
	Telegraph service	1.84	
Total cost of control work		$2,943.87	100.0%

Analysis of Control Cost:

Wages represented approximately 70% of the total cost, while the next largest items, provisions and transportation, cost 23% and 6% respectively. The total cost of the control work was $2,943.87 of which $300.00 is charged to control work in the yellow pine. The balance, $2,643.87, was utilized in lodgepole pine control work. Therefore the unit cost of treating the 43 yellow pine trees was $6.98 per tree and $5.80 per M.B.M., and the cost of treating the 2,469 lodgepole pine trees was $1.07 per tree.

II - RESULTS OF THE CONTROL WORK AND CHARACTERISTICS OF THE INFESTATION.

Results:

During the period of control operations work was conducted on all infested areas in the park south of Crater Lake. The location of these areas and their positions relative to each other are shown on the map, page 13 .

The actual reduction of the annual infestations secured by the two years of control work, as shown by the survey made in October, 1926, is given for each area in the following table; .

Area.	Number of trees 1925 infestation treated in spring of 1925.	Number trees of 1926 infestation treated in spring of 1926.	Percent of reduction from 1925.	Numbertrees of 1927 infest. treated in fall of 1926	Percent of increase or decrease from 1926.
A	1,815	300	84%	0	
B	643	85	87%	0	
C	61	2	97%	0	
D	98	10	90%	0	
E	853	436	49%	0	
F	801	394	50%	292	26% red.
G	20	0	100%	0	
H	0	324		0	
I	0	74		464	510% incr.
J	0	43		0	
Totals	4,291	1,756		756	

Area J is the yellow pine infested area at the South Entrance. This area was not treated in 1925. Following the control work of 1926 the infestation on the area completely subsided. No infested trees could be found in October, five months after the control work.

Areas H and I contained no infestation in the spring of 1925 and therefore were not treated at that time. However, and infestation developed on them during the following fall and was treated in the spring of 1926. The other areas were all treated in 1925 and those which were re-infested; (areas A, B, C, D, E, and F,) were again worked in 1926. It will be noted that a high percentage of reduction was secured on all of the areas worked in 1925, except Areas E and F, where the reduction was only 49% and 50%, respectively.

Following is a table showing the estimated amount of re-infestation which has developed on the worked areas since the last control work. The figures given in these estimates are based on the data secured by the survey made in October, 1926.

Area.		Estimated 1927 infestation.
A	-	75 trees
B	-	50 trees
C	-	0 trees
D	-	0 trees
E	-	100 trees
F	-	50 trees
G	-	0 trees
H	-	50 trees
I	-	2,500 trees
J	-	0 trees
Total	-	2,705 trees

The difference between the number of infested trees given above on each area and the number treated on that area in 1926 (see table, page 8) is the reduction in the infestation secured by the last control work. This reduction in percent is as follows: Area A - 81%, B - 41%, C - 100%, D - 100%, E - 77%, F - 90%, H - 84%, and J - 100%. The infestation on Area I shows an increase, the reason for which will be made apparent further on in this report.

A comparison of the initial infestation on all of the control areas at the time the project was started in 1925 with the infestation developed after the control work of 1926, will show in a better way the degree of success obtained by the control work so far done. This comparison follows:

Infestation in 1925 (treated in spring of 1925) ... 4,291 trees
Infestation in 1927 (developed after the spring work of 1926) ..... 597 trees

This shows a reduction of 86% secured by the two years of control work. It does not, however, take into consideration the new infestation which developed in the fall of 1926 on Area I, to which further reference will be made.

It is evident that the control work so far accomplished on this project has been successful in reducing the annual infestations to a relatively low point. Practical elimination of the beetles has been secured on all of the infested areas except F and I.

Following is a discussion of the infestations on these areas and an analysis of the remaining infestations of the entire project.

Analysis of Characteristics of the Infestation:

In the preceding part of this report under heading "Results", the problem of the mountain pine beetle re-infestation of the lodgepole pine control areas was dealt with. It is evident that if the re-infestation of these areas had not occurred the control work of 1925 would have successfully terminated this project.

Early in the spring of 1926 it was apparent that some of the control areas had been considerably re-infested during the flight period of July and August, 1925, and later, following the flight period of 1926, there was conclusive evidence that another invasion of these beetles had taken place. That these infestations were not caused by beetles which had escaped the control work is proven by the fact that areas H and I, which had not been previously infested, were attacked after the control work; area H in 1925, and area I in 1926. The location of the source of these re-infestations was thus a problem which required investigation.

Since these re-infestations did not originate on the control project it was necessary to look beyond the treated areas for their source. As no infestations outside the control areas exist in the park south of Crater Lake this region was eliminated. The old infested areas north of the lake (see map) remained as the only probable source. An examination of these areas revealed that these infestations had been in progress for a period of at least ten years and that the beetles had gradually spread from old epidemic centers until they had infested all the lodgepole in this region. An interesting and significant discovery was made by examining the beetle killed lodgepole stands. These showed that the progress or "drift" of the annual infestations had been consistently in a south-westerly direction. This fact was further supported by examinations made in the new infested lodgepole stands in the west central part of the Park. These stands have only recently been invaded and the drift of the beetles infesting them has also been toward the southwest. This is shown by the fact that the first trees attacked are on the north-east exposure of the infested areas. A study of the records of mountain pine beetle infestations in lodgepole pine in other regions, notably in the Yosemite Park, also showed the same peculiarity.

The discovery of this drift in the Crater Lake Park was of significance, because the control areas and the lodgepole pine stands in the west central part just described, are in its path. Further evidence supporting this suspected cause of the re-infestations was the fact that the last trees attacked in the old areas north-east of the lake are located on their south-western border and that these places represent the last stand of the beetles in this locality. These old areas were abandoned in 1926, because all the lodgepole in them had been killed. The flight of 1926 represented the last remnant of their beetle population and this remnant was forced to migrate to living stands of lodgepole. One of the last epidemic centers in

these old areas abandoned by the beetles in 1926 is located on the rim of the lake near Round Top, (see map). This point is directly north-east of the Munson Valley region where the greatest re-infestation of the control areas occurred in 1926. This re-infestation is believed to have been caused by an invasion of beetles migrating from these old epidemic centers.

Another factor which probably contributed to this movement of beetles into Munson Valley was the burning day and night, during the flight period of 1925, of slash along the new rim road which was under construction from Government Camp to the Lodge at the north end of Munson Valley. It is well known that the mountain pine beetle is readily attracted to burning slash. The map shows the relative location of all the infested areas above discussed. The red arrows are drawn on the map to show the direction of the migration of the beetles. Control areas F, H, and I, are the only areas in direct line with this suspected drift. It seems the above evidence is sufficiently conclusive to warrant the statement that the 1926 re-infestation of the control areas F, H, and I, was caused by beetles migrating from the old-standing infestations north-east of the lake.

That there is no great hazard of such migration and consequent re-infestation of the areas south of the lake again occurring seems assured because there are not enough beetles now remaining in these old areas to make it possible. The 1926 flight represented practically the total beetle population of the region north-east of the lake.

RECOMMENDATIONS FOR 1927.

Yellow pine areas - Infestations of Dendroctonus brevicomis:

Due to the success of the control operations last spring on Area J, this area is now free from beetle infestation. No more control work for the present is recommended on this area. There are no other infestations in yellow pine in the Park.

Lodgepole pine areas - Infestations of Dendroctonus monticolae:

It is recommended that all the lodgepole pine areas which have been re-infested since the spring control work of 1926 receive attention in the spring of 1927. If this recommendation is carried out, the result should be as near to a complete elimination of the beetles in the south half of the park as it is possible to attain with present control methods. Such conditions, when secured, will, it is believed, insure freedom from beetle depredations in these stands for a number of years. The control work already done has resulted in greatly reducing the original infestations. It is believed that continued control work in 1927 will secure final control of these areas unless unfavorable conditions, which are now unforseen

arise.

There is a total of approximately 2,700 infested lodgepole pine trees which it will be necessary to treat in the spring of 1927. These trees are located on the separate control areas as given on page 9 under heading "Results".

Approximately 2,600 of these trees are on areas F, H, and I, in the Munson Valley region. It is here that the 1927 control work should be centered. The control areas in the Sand Creek region are, with the exception of Area A, practically under control now and will require very little attention. Area A, at the East Entrance, should be re-worked providing the Forest Service carries out control work in the adjoining infested area in the Crater Forest. It is not recommended that any further work be done on this area unless cooperation with the Forest Service is accomplished, because otherwise the area will be yearly reinfested from outside the Park.

The cost of the above recommended control work will amount to from $2,500 to $3,000. $2,500 is the minimum amount with which it will be possible to accomplish sufficient work to secure control of these areas.

Failure to carry out this work in 1927 will not only jeopardize the results already obtained but would also endanger the success of the entire project.

Stanford University,
California.
January 24, 1927.

MAP OF THE CRATER LAKE CONTROL PROJECT.

LEGEND FOR MAP.

CONTROL AREAS.

A - East Entrance

B - Lost Creek

C - Sand Creek

D - Wheeler Creek

E - Lava Beds

F - Munson Valley

G - Anna Spring

H - Garden of Gods

I - Crater Rock

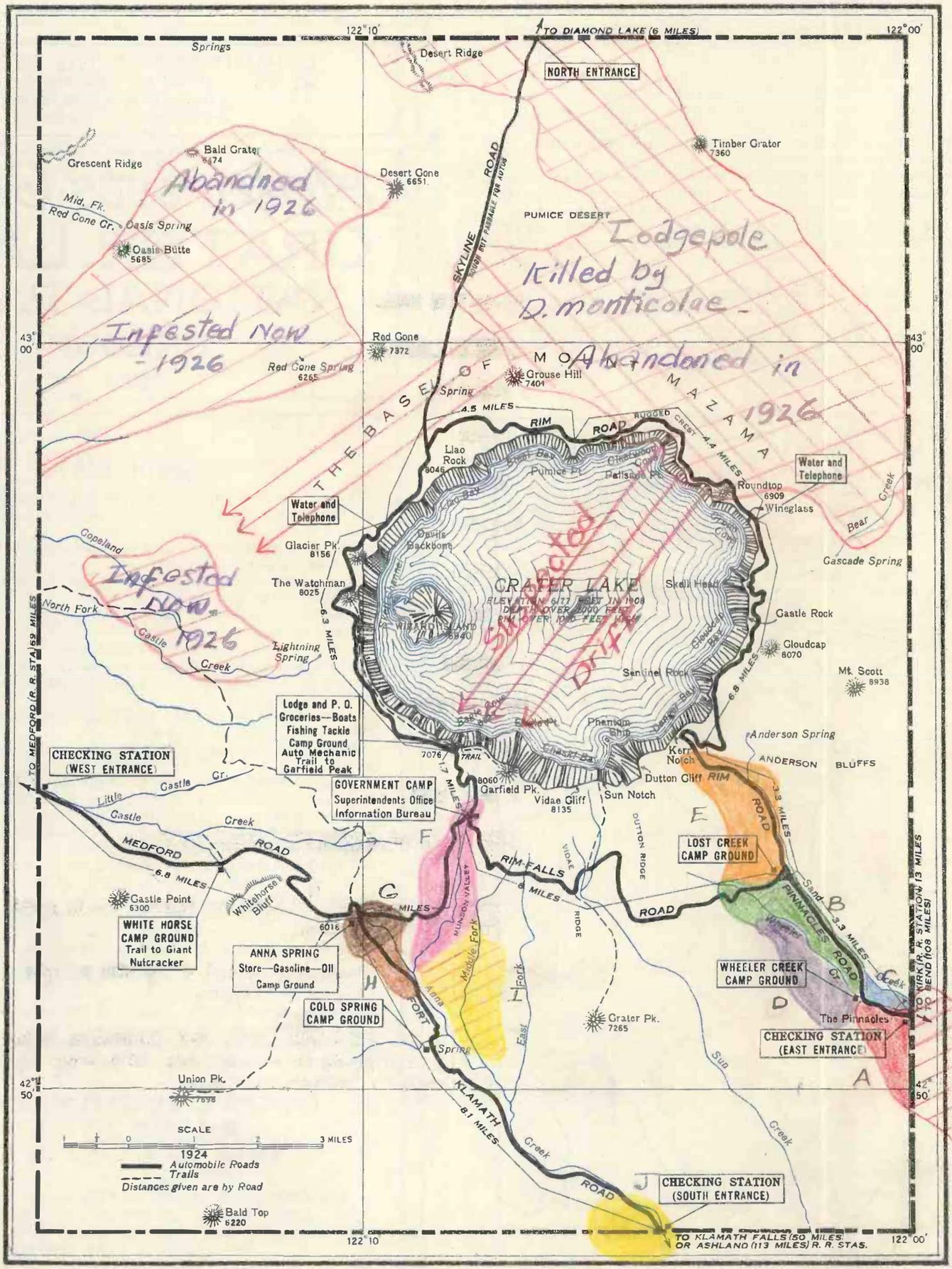
J - South Entrance

INFESTATIONS NORTH OF CRATER LAKE.

- Lodgepole pine areas killed by the mountain pine beetle - now abandoned.

- Lodgepole pine areas now infested by the mountain pine beetle.

The red arrows show the route and direction taken by beetles migrating from the areas abandoned in 1925 to recently infested areas.



GUIDE MAP SHOWING ROADS IN CRATER LAKE NATIONAL PARK

CAMPING is permitted throughout the park on specially designated camp sites.
Leave clean grounds for the next camper.

CRATER LAKE PARK was established by act of Congress approved May 22, 1902 (32 Stat., 202). It is in the very heart of the Cascade Range in southern Oregon, and has an area of 159,360 acres.

Crater Lake is a body of water of extraordinary blue in the crater of an extinct volcano. It is approximately in the center of the park.

The Rim Road, 35 miles in length, which entirely encircles the rim of the crater, is destined to become one of the famous scenic highways of the world. From many points on this road, motorists may obtain marvelous vistas of the lake lying over a thousand feet below.

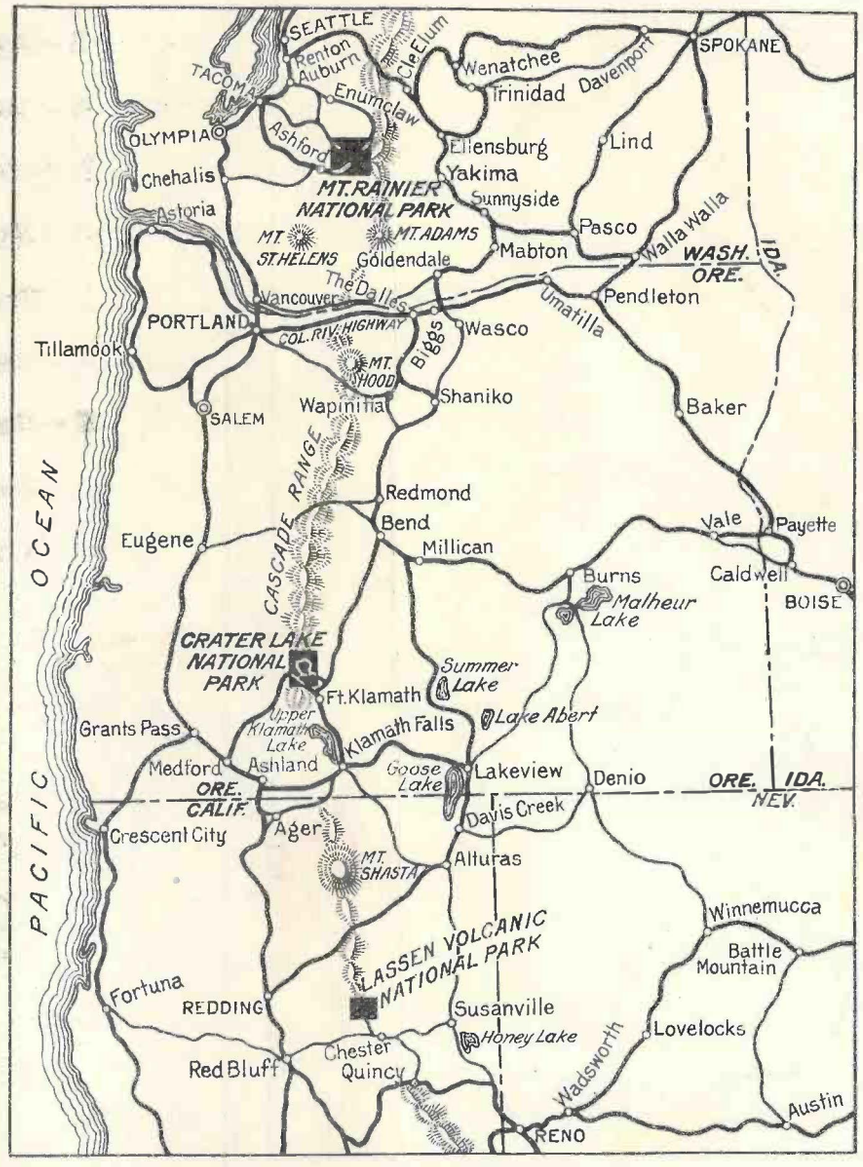
There are good roads entering the park from Medford on the west and Klamath Falls and Bend on the east. All of these roads connect in the park and all join the Rim Road. There is a trail leading down to the boat landing on the lake. From this point trips may be made with motor boat or rowboat to Wizard Island, Phantom Ship, and other interesting points. All of the lake trips afford excellent opportunities for studying the surrounding cliffs.

Trout fishing in the lake is excellent; the limit for a day's catch is 5 fish.

Motorists will find hotel and camp accommodations in the park. Crater Lake Lodge on the rim is open throughout the season, and a comfortable camp is maintained at Anna Spring, about 5 miles from the rim of the crater.

A free public camp ground is also maintained on the rim.

All camp grounds in the park are free.



MAP SHOWING POSITION OF
CRATER LAKE NATIONAL PARK
IN OREGON
WITH PRINCIPAL CONNECTING ROADS

DEPARTMENT OF THE INTERIOR
HUBERT WORK, SECRETARY
NATIONAL PARK SERVICE
STEPHEN T. MATHER, DIRECTOR

Motorists Guide
CRATER LAKE NATIONAL PARK
OREGON
1924

USEFUL HINTS

This Park is a National playground. Observance of the following rules and suggestions will make your visit pleasant and add to the pleasure of others.

The use of automobiles and motorcycles will be permitted at all hours on any of the roads in the park.

The entrance fees for motor vehicles are as follows, and are payable in cash at points of entrance:

Automobiles, season permit, $2.50.

Motorcycles, season permit, $1.00.

Careful driving is required at all times.

The speed limit is 12 miles per hour on grades, and when rounding sharp curves. On straight stretches of road, a speed of 20 miles is allowed.

Horn should be sounded when approaching curves, vehicles, pedestrians, or saddle animals.

Muffler cutout must be closed when passing horses, hotels, or camps.

Do not drive in the ruts of the road. Observance of this suggestion will do much toward keeping the roads smooth and in good condition, and may save you a broken spring.

Teams have the right-of-way at all times and in all places. If horses appear nervous, automobile will take the outer edge of the road and engine will be stopped until horses have passed.

Be careful of your camp fire. Thoroughly extinguish it before leaving, by water or covering with earth.

Camp, and park your car only in designated localities.

For the protection of yourself and other visitors, your car must be equipped with good brakes, horn, and lights.

THESE ARE NOT THE REGULATIONS.—There may be obtained from the rangers at the entrances, or from the Superintendent, copies of the Rules and Regulations pamphlet for the government of the park and motor vehicle traffic therein. The Rules and Regulations pamphlet also contains general information regarding the park.

CRATER LAKE NATIONAL PARK
BELONGS TO YOU.
HELP TAKE CARE OF IT.

FOR ADDITIONAL COPIES OF THIS GUIDE OR FURTHER INFORMATION CONCERNING CRATER LAKE OR OTHER NATIONAL PARKS ADDRESS THE NATIONAL PARK SERVICE, WASHINGTON, D. C.

No. 6230 - Showing method used in treating yellow pine trees infested with Dendroctonus brevicomis on Area J. The trees were felled, the infested bark removed from the logs, and the bark burned in pits dug in the ground. A pit containing burning bark can be seen at the extreme left.

6230

J. E. Patterson,

No.6251 - Showing method of preparing lodgepole pine trees, infested with broods of Dendroctonus monticolae, for sun curing. The infested logs are limbed and topped and the prostrate trunk exposed so that the direct rays of the sun fall on it.

6231.
J. E. Patterson.

No.6252 - Illustrating another phase of the sun curing method of treating lodgepole pine trees infested with broods of Dendroctonus monticolae. After the felled logs are limbed and topped the brush is piled away from the logs in order to allow the sun to shine directly upon them. The piling of the limbs and tops allows of their being easily burned after the first storms make burning in the forest safe.

6232
J. E. Patterson.

No.6233 - Illustrating the last stage of the sun curing method of treating infested lodgepole pine trees. After the logs have been felled and prepared by limbing and topping they are left to the exposure of direct sunlight for from 2 to 4 days. They are then turned in order to expose the under side. With an exposure of similiar duration in the latter position the brood on all surfaces of the logs are effectively killed. It was found that in the Crater Lake Park temperatures of from 110 to 120 degrees F. were attained in the cambium layer with a minimum exposure of 1 hour during any part of the period from 10AM to 3PM on days of unobstructed sunlight.

6233

J. E. Patterson.

No.6254 - A "Ghost Forest". Lodgepole pine trees in Crater Lake Park that have been killed some years past by the mountain pine beetle, Dendroctonus monticolae. This scene is typical of many areas in the Park. These trees are silent witnesses of former devastations by this beetle. Many of these killed areas are now coming back with a new type of forest composed of a mixed stand of lodgepole pine, red fir, and hemlock.

0234
J. E. Patterson.